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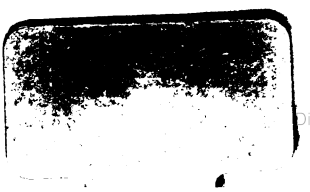

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MEMOIRS OF THE GEOLOGICAL SURVEY.

ENGLAND AND WALES.

THE GEOLOGY

OF THE

NEIGHBOURHOOD OF COLCHESTER.

Old Series

(EXPLANATION OF QUARTER SHEET 48 S. W. OF THE GEOLOGICAL SURVEY MAP.)

BY

W. H. DALTON, F.G.S.

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NOTICE.

QUARTER SHEET 48 S.W. was almost entirely surveyed in the years 1873–75 by Mr. W. H. Dalton, under the superintendence of Mr. Whitaker. The exceptions consist of some small areas (amounting altogether to about five square miles) along the eastern edge, and at the south-western corner, of the Map, which were done by Mr. Whitaker and Mr. H. B. Woodward respectively in surveying the adjoining Maps to the East and South.

This explanation has been written by Mr. Dalton. Mr. Whitaker has, however, written the Introduction and made some additions, besides arranging and editing the whole.

The Lists of Fossils have been revised by Mr. Etheridge, F.R.S., the Palæontologist to the Survey.

H. W. BRISTOW,
Senior Director.

Geological Survey Office,
28, Jermyn Street, London, S.W.
1st December 1879.

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THE GEOLOGY

OF THE

NEIGHBOURHOOD OF COLCHESTER.

INTRODUCTION.

THE greater part of this district, which is about 190 square miles in area and forms part of the London Basin, is drained by the Colne and tributaries, the chief of which is the Roman River, with its feeder the Layer Brook (rising respectively in the neighbourhood of the Teys and the Layers); the S.W. corner by the tributaries of the Blackwater, the East by the brook descending by Tendring and Thorpe to Little Holland, and the N.E. corner by tributaries of the Stour.

The area for the most part forms a plateau, the highest points of which are on the western edge, at Great Tey and Tiptree Heath, 196 and 193 feet above the sea. From these the ground falls eastward with comparative regularity (except for the valleys) to 100 feet near Wicks, on the N.E., and to 50 feet on the cliffs of Mersea and Clacton, on the south. The alluvial flats of the estuaries of the Colne and of the Blackwater are below high-water mark.

The geological interest of the district lies in the Post-Glacial Drift, which, though occupying only small areas, has not only yielded nearly all the fossils of the district, but is known to geologists from the sections of Copford and Clacton.

The following is a list of the beds shown on the map:—

Recent - -	Blown Sand. Shingle. Alluvium.
Post-Glacial Drift -	Loam, or Brickearth. Gravel.
Glacial Drift -	Boulder Clay. Loam. Gravel and Sand.
Pliocene - -	Red Crag.
Eocene - -	London Clay.

The underlying Woolwich and Reading Beds (with probably a trace of the Thanet Beds) and the Chalk are touched in deep wells, (see Appendix I.) From the well at the Colchester Waterworks numerous minute fossils have been obtained by carefully washing the fragmentary chalk and examining it under a lens. These consist of small Serpulæ, ossicles of Apiocrinites, and remains of Amorphozoa, Foraminiferæ, Bryozoa, and Entomostraca; such as

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are usually plentiful in and characteristic of the Chalk."* A list of some of these is given in Appendix II.

LONDON CLAY.

The London Clay extends over the whole district, being frequently exposed in large continuous areas, and in no place concealed by any great thickness of superficial deposits.

Where exposed along the bottom of minor valleys cut through the Drift the original tenacity of the clay is greatly lessened at the surface by the washing down of sand, but where no covering of Drift occurs the clay forms very stiff heavy land.

The London Clay has been dug, for the manufacture of either tiles or bricks, at Seven Stars Green, near Fordham, and is used in combination with Drift loam, in two brickyards on the brook separating West Bergholt and Mile End. It is exposed in the railway-cuttings between Marks Tey and Ardleigh and on the Tendring Hundred Railway, and has been dug at Cock Heath brickyard, N.E. of Colchester.

In the brickyard N.E. of Colchester it is bedded and contains calcareous bands. It is cut into by the railway ascending to St. Botolph's Station, and worked in a brickyard near the Distillery. At East Donyland, S.S.E. of Colchester, two brickyards are worked in it, and it is exposed in several road sections in the valley of the Roman River, the minor tributaries of which cut into it. South of Abberton and Great Birch it forms nearly the whole surface, only the hill-tops having a cap of gravel. At Great Wigborough, which rises to a height of 140 feet, no gravel occurs, though it is present at both higher and lower levels. Hardly any good sections occur in this part, except a low cliff on the Ray, between Little Wigborough and Mersea.

East of the Colne the London Clay is seen on the railway in nearly every cutting, and there are brickyards in it at Brightlingsea, Alresford, and St. Osyth. Fine sections occur on the cliffs at Clacton-on-Sea, where it contains abundance of septaria crowded on the surface with organisms resembling fucoid stems, converted sometimes into iron pyrites, but more generally into the calcareous material composing the septaria.

Similar septaria occur on the railway near Stanway.

Fine specimens of *Nautili*, the interior filled with cement stone, are occasionally found in place in excavations, or dredged up off the coast.

RED CRAG.

Shelly Crag occurs near Beaumont Street,† and near it is some ironshot loam containing masses of ferruginous sandstone, which may belong to the Crag, but we have not ventured to map it as such.

On the watershed between the Stour Valley and Tendring Brook, a cutting near Horsley Cross, on the abandoned Mistley and Thorpe Railway, shows ironstone with occasional impressions of shells, under loam.

* J. Brown, *Ann. Nat. Hist.*, ser. 2, vol. xii., p. 240 and plate.

† See "The Geology of the Eastern End of Essex (Explanation of Quarter Sheet 48, S.E.)," p. 11. (1877.)

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GLACIAL DRIFT.

Gravel, Sand, and Loam.

The lowest member of the Glacial Series in this district consists of gravel, sand, and loam, the first being the most common, covering a large amount of surface, and also underlying great part of the widespread mass of loam in the N.E. part of the district. The greatest thickness of this set of beds is about 80 feet, at Lexden Heath. They occur over the greater part of the higher ground, and are cut through by the valleys.

N.E. of West Bergholt, the gravel is much covered with a pebbly loam, which forms a porous and fertile soil.

The brickyard at the back of "The Crown" at Ardleigh showed, in 1875, finely bedded brown and grey loam, free from pebbles, with pockets of gravelly sand, slightly contorted, 8 to 10 feet thick, overlying whitish sand.

In the Colne Valley, W. of West Bergholt, the gravel is very irregular in its occurrence, and of no great thickness anywhere. On the railway near Stanway it is seen to come between the London Clay and loam. About Stanway it varies in thickness from 35 to 60 feet.*

It occupies nearly the whole area between the Colne and the Roman River, being about 30 feet thick in Colchester.

On Tiptree Heath, and at Messrs. Davey, Paxman, & Co.'s Engine-works at Colchester Hythe, small patches of good brick-earth overlie the gravel. A like patch occurs in the large gravel-pits at Ballast Quay Farm, Wivenhoe.

East of Colchester the gravel passes under a sandy loam, that covers most of the country as far as Tendring, beyond which outlying patches of gravel loam, &c., lie on a spread of London Clay. Near Little Bentley, Great Bentley, and Wivenhoe Cross, the gravel is cemented by iron into a coherent mass, overlying looser material. At Weeley Heath stiff clay lies on sand. At Brightlingsea and St. Osyth a considerable thickness of gravel occurs, and is dug in several places, whilst near Bentley and Weeley the gravel is very thin.

The outlier of Buckingham Corner consists chiefly of sand, the other outliers of gravel, except those of Tendring and Beaumont Street, which are partly loam and partly gravel. At Brockett Hall is a patch of pebbly loam on London Clay.

Boulder Clay.

This deposit consists of a bluish-grey clay, weathering yellowish, and full of more or less rounded pieces of various rocks, among which chalk is most common.

It is confined to the N.W. corner of our district, where it either overlies the gravel, &c., just described, or rests direct on the London Clay. As in the district to the west (Sheet 47) it is often covered by loamy soil.

Between Easthorpe and Birch the Boulder Clay lies in a hollow, either denuded in, or formed by the irregular deposition of, the gravel.

The junction of the Boulder Clay with the gravel is exposed at Harborough Hall, and has been proved in a well at Pots Green, at a depth of 35 feet.

The cutting near Aldham is hidden, but London Clay, gravel, and Boulder Clay occur in it.

Near Checkley the junction of gravel and Boulder Clay is cut through at each end of the cutting, but no distinct section remains.

Inliers of gravel occur at Great Tey, Aldham, Copford, and Easthorpe.

North of the Colne, the junction of Boulder Clay and gravel was seen at Fordham, Cripping Hall, Bots Tye Green, and near Chapple Station at the

* J Brown, *Mag. Nat. Hist.*, vol. vii., p. 436–438 (1834).

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junction of the two railways, and in a well in the road near the station, which was carried through the gravel to the London Clay, at a few feet in depth. At one point at Fordham the gravel is but six inches thick. North of West Bergholt, the eastern boundary of the Boulder Clay is made indistinct by the loamy nature of the underlying beds; but the stiff yellow clay on the N.W. of Scarlets prevails to and beyond sections in ordinary Boulder Clay on the north of Pictsbury Wood, and accordingly is mapped as Boulder Clay.

POST-GLACIAL BEDS.

1. *Near Marks Tey.*

The Post-Glacial deposits in this neighbourhood occupy an area of a mile and a half in length from east to west, and a third of a mile in breadth from north to south, on the southern side of the brook between Stanway and Copford parishes.

The large brick-yard N.E. of Marks Tey Church gave, in 1875, fine sections of the Post-Glacial deposits. At the N.E. end of the field (adjoining the Sudbury Branch Railway) is a thick bed of laminated brickearth, capped with a little gravelly rain-wash and resting on hard gravel. The lower part of the brickearth (18 feet) is dark blue, the upper part (10 feet) is brown; the lines of lamination crossing the boundary of the colours, show that the difference is produced by weathering from the surface to a depth of 10 feet. Fossils occur rather plentifully in the unweathered part, and at one place a thick lenticular mass of peaty clay occurred.

To the S.W., behind the kilns, a small pit showed the following beds:—

1. Grey clay, like marsh-silt, 3 feet.
2. Streaky loamy sand with chalk grains, 3 feet.
3. Sandy clay, a foot.
4. White unctuous marl, like underclay, 1¼ feet.
5. White sandy gravel, 8 inches.

Blue Boulder-Clay.

Nos. 2 and 4 thinned away to the N.W. within a few yards. A ditch leading from the farm by the church to near this pit showed Boulder Clay, marl, loam, and the silty clay (1), but there was no very distinct section. Opposite the farm are two large pits, one showing brown loam, the other giving at its N.E. corner (where the water in it escapes into the aforesaid ditch) the following section (1875):—

Grey silty clay, with a few stones and some bones, up to 3 feet.
Thin irregular layer of gravel.
Shelly marl and shell sand, 4 feet seen.

The junction of the marl with the underlying Boulder Clay was not exposed, though sections in the latter occurred close by, on a level with the lowest exposed part of the marl. The silty clay probably extends the whole length of the field.

At Marks Tey Station the Boulder Clay passes down under red sand and brown loam. Marl occurs on the road between the station and the brook to the north.

The large pits at the brickyard (marked on the Ordnance Map) north of Copford Place have been described at various times by the late Mr. J. Brown of Stanway* who paid much attention to the Drifts of Essex, and made a large collection of fossils, &c. from them, great part of which is now in the British Museum.

In writing the following description of the Copford section Mr. Brown's papers have been freely used for parts not to be seen during the progress of the Geological Survey, in 1873–75.

* *Mag. Nat. Hist.*, vol. vii., pp. 436–438 (1834); vol. ix., pp. 429–431 (1836). *Proc. Geol. Soc.*, vol. iv., pp. 164, 165 (1843). *Quart. Journ. Geol. Soc.*, vol. viii., pp. 184–193 (1852).

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At the N.W. corner of the ground, occupied by the kilns, sheds, &c. is one large pit, referred to by MR. BROWN as the western pit. 250 yards east of this is another pit, now ploughed down, except a small pond at one corner. This is the "eastern" section of MR. BROWN'S papers and extended to the northern edge of the section in 1874, which comprises the "southern" section of 1852, with the addition of the space then unexposed between it and the "eastern" section.

The southern pit is now sloped down on its southern and western sides.

The order of the beds, as shown by combining the sections in various parts of the brickyard, is as follows:—

Alluvium —
- Peat, with land and freshwater shells still retaining their epidermis. Occurs on the N. of the brickyard.
- Clay and detritus, with land and freshwater shells; about a foot.
- Peat, with many land and freshwater shells, as above; 6 inches to a foot.

1. Rainwash.—Brown clay, with boulders of various rocks. This was regarded by MR. BROWN as belonging to the Glacial Series, in which he thought the fossiliferous beds to be intercalated; but it is clearly the result of the weathering of the Post Glacial beds, and of the Boulder Clay of the neighbourhood, and it covers all indifferently; up to 3 feet.

Post-Glacial Drift.
- 2. White sand, shelly, 0 to 3 feet.
- 3. Shell-marl, consisting of white homogeneous unctuous clay, shelly sand, and ferruginous sand and clay, from 5 to 6 feet; in the N.W. pit it consists of 10 inches of shell-sand, covered by 4½ feet of unctuous marl. Has yielded 69 species of mollusca, besides mammalian remains, &c. (see p. 20).
- 4. Peat, with much clayey matter throughout, and not so inflammable as ordinary peat; contains freshwater shells in groups. On the N. edge of the brickfield 7 feet, but only a foot in the N.W. pit, where it thins away southward, and only 6 inches in the E. pit.
- 5. Brickearth.—A dark blue micaceous and calcareous clay, the upper part with nodules of race and many freshwater shells. Small pebbles and angular fragments of various rocks, and patches of ferruginous sand occur, chiefly in the lower part. In the N.W. pit many rounded pieces of soft chalk at a depth of 8 or 10 feet. On the W. 13 feet, but only 11 on the E.
- 6. Grey sandy gravel, with pebbles of chalk and a few fossils; about 10 feet.

Possibly Glacial.
- 7. Brickearth.—A finely laminated bluish-grey calcareous loam, turning whitish when dry, and weathering at the surface into a rich brown loam. Layers and nodules of race occur near the surface. About 18 feet.
- 8. Grey sandy gravel, at the southernmost point.

The north-western pit reaches to a depth of about 13 feet in the upper brickearth (5), below which is quicksand several feet deep. The eastern and southern sections exhibited the above series in 1852, although, not being then connected in a continuous exposure, the relation of the two brickearths was not seen by MR. BROWN, who regarded them as one.

In the section (Fig. 1) the beds dip N.E. at about 10°, undulating slightly. About 100 yards from the southern end they roll over and dip westward, but almost immediately regain the northerly dip, with an angle of 5°. On the western side of the southern pit the dip varies from S. to nearly E. These undulations are accompanied by two small faults, due probably to a slipping of the deposit towards the valley on the north.

The lowest bed may be the gravel which underlies the Boulder Clay in the neighbourhood, the latter having been denuded away. The overlying brickearth may also be of Glacial age, being without fossils, and resembling in lithological character some of the loams associated with the Glacial gravels.

In the accompanying illustration (Fig. 1) the reference numbers are the same

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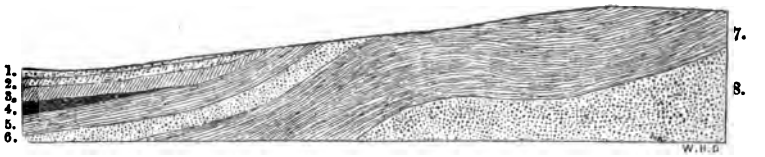
as in the above description. The northern part of this section is from Mr. Brown's paper of 1852,* and the southern from observation, in 1874.

Figure 1.—*Diagram-section of the Eastern Side of Copford Brickfield.*



An old pit, now ploughed over, occurs on the southern side of the road near the windmill, but only traces of shell-marl can be detected in it.

According to Mr. S. V. Wood, three of the *Helices* from the shell-marl no longer live in England; of these *H. fruticum* and *H. incarnata* occur in France, and *H. ruderata* in Sweden and Switzerland. Through the kindness of the Council of the Geological Society we are enabled to reproduce the woodcuts of *H. incarnata* and *H. ruderata*.

Figure 2.—*Helices from the Copford Deposit.*†

Helix incarnata. *Helix ruderata* (magnified).

The following is from an anonymous work published in 1818‡:—

"In the year 1764, on the south side of the London road [at Stanway Manor House], a number of large bones, vertebræ and tibiæ, with their joints, were found lying in a stratum of sea sand and small shells. The bed was about a yard thick, and above it another of ooze, or river mud, of 3 inches in thickness, over which were several veins of yellow sand, gravel, and mould. The tibiæ were much corroded, but the other bones perfectly well polished."

Whether this deposit is part of the Post-Glacial series, or more recent, is not, in default of more exact information, determinable. The term sea-sand probably means well-rounded sand, for no Post-Pliocene deposit containing marine shells is known to occur in this district, except at the Clacton cliff, the summit of which is quite 50 feet below the level of any point near Stanway Manor House.

2. *Lexden.*

The section at a brickyard on the southern side of the Colne near this village was described in 1863 by the Rev. O. Fisher. The site being now ploughed over, the accompanying figure and description are taken from his paper.§ The chief interest of the deposit here lies in the remains of Coleoptera found in the bed of peat, which, according to Mr. T. V. Wollaston, belong mostly to non-British genera, one of which is of Mediterranean distribution, a fact of great importance in connection with the occurrence at Copford of non-British *Helices*.

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* *Quart. Journ. Geol. Soc.*, vol. viii., p. 184.
† *Quart. Journ. Geol. Soc.*, vol. viii., p. 190.
‡ "Excursions in the County of Essex," p. 65.
§ *Quart. Journ. Geol. Soc.*, vol. xix., pp. 393–401.

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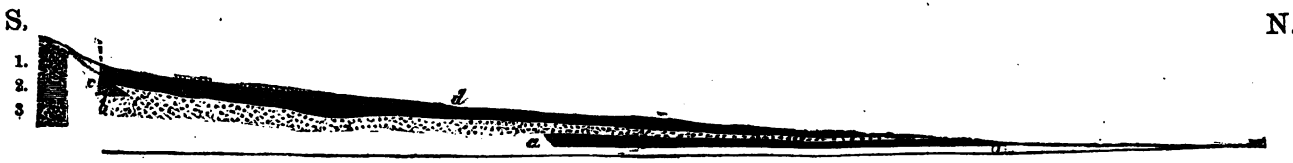
FIGURE 3.—*Section through the old Brickyard at Lexden.* (FISHER, Quart. Journ. Geol. Soc., vol. xix., p. 395).*



Wash of sandy gravel and loam, with small sub-angular flints (probably the remains of larger pebbles split by frost, &c).

Post Glacial Drift.

- *d.* Brickearth.—A brown sandy loam, with lines of bedding, which, at the southern end, conform to the slope of the talus. Contains a few very thin layers of pebbles. A singular red stone, which seemed to have been burnt, occurred at the junction with the talus *c.*; 9 feet, passing down into the next.
- Whitish clay; a foot.
- Yellow clay and whitish gravel, thin.
- *c.* Peat, with much sand and gravel on the southern side. Yielded mammalian remains in abundance; amongst them the bones of the feet of an elephant in juxta-position. Remains of *Coleoptera* also occurred in abundance; up to a foot.
- Carbonaceous clay, with rootlets, passing down into
- Fine grey sand; up to 3 feet.
- *b.* Clayey gravel, with a few large slightly rolled flints, one weighing about 25 lbs.; 7 feet and more, resting on London Clay.

Glacial Drift.

1. Gravelly sand; 16 feet.
2. Sand, the bottom 6 inches loamy; 20½ feet.
3. Coarse gravel with water, not pierced.

a. London Clay, with septaria and pyrites.

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* For this woodcut we are indebted to the kindness of the COUNCIL OF THE GEOLOGICAL SOCIETY.

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On the south an ancient talus, fallen from the bank of Glacial gravel against which the more modern deposits abut, protrudes into the clayey gravel in the form of a wedge, its point being intercalated with the clayey gravel, the beds of which above the point are slightly bent upwards, partly conforming to the slope (30°) of the talus.

The grey clay, with the overlying peat, fills a trough about 30 feet wide, parallel to the southern boundary, the clay extending north and south beyond the edges of the peat, and both being planed off to a general surface, on which the yellow clay and whitish gravel lie unconformably.

The peat thins to the east, but what remains is unaltered in character as if it were the remainder of a thicker mass, the upper part of which has been removed by denudation. A bed of gravel, dug between Westhouse and Lexden Lodge, appears to belong to the same series as the above.

3. *Colchester.*

Near Colchester Station are three brickyards, one south of the railway, a second north, and the third a little further east. The first shows only brickearth, from which bones have been got. The second shows, on its western edge, a mass of London Clay, apparently slipped from the hill between it and the station. Against this abuts brickearth, with a few bones, resting on sand with a few flint pebbles. The remainder of the pit is in more or less pebbly loam, from which bones and stags' horns have been obtained.

The north-eastern pit showed (1875) a fine section of evenly-bedded brownish-grey brickearth, about 30 feet thick, with a clayey band about the middle, and a cap of gravel about 5 feet thick. It is said to rest on sand. Bones and teeth occur in this brickearth.*

4. *Clacton-on-Sea.*

The deposits shown in the cliff-section at this place are of more than usual interest from the light they throw on former geographical conditions.

The section was first described by Mr. J. BROWN,† and afterwards by the REV. O. FISHER.‡ It has varied from time to time as the sea cut back the cliff. The deposit ranges inland as far as Great Clacton, but good sections are rare.

Mr. BROWN describes the cliff-section as showing all the beds down to low-water mark, and gives the following details:—

Vegetable soil.	
Loam with flints, both rounded and angular, and quartz.	
Layer of freshwater shells in red sand (= 3 of fig. 4.)	
Peat.	(= 5 of fig. 4.)
Layer of marine and freshwater shells	
Peat with subordinate and interrupted beds of marine and freshwater shells	
Layer of marine and freshwater shells	(= 6 of fig. 4.)
Bones of mammals with freshwater shells, trunks of trees, nuts, and seeds. [This seems to have reached from low-water mark up the slope of London clay, and possibly does not extend far inwards from the edge of the deposit. It was probably the result of animals getting mired at the edge of the marsh.—W. H. D.]	
London Clay at low-water mark.	

* Rev. O. FISHER, *Quart. Journ. Geol. Soc.*, vol. xix., p. 393; and W. H. D., 1874, 75.

† *Mag. Nat. Hist.* ser. 2, vol. iv., p. 197 (1840).

‡ *Geol. Mag.*, vol. v., p. 214 (1868).

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The deposit is said to be about 18 to 20 feet thick and to extend 600 yards along the cliff and 80 yards outwards from it. Elsewhere Mr. BROWN writes that marine shells of the same species as there found on the coast, associated with freshwater shells of species also common in the neighbourhood, occur at various heights above high-water mark, the highest bed being 8 feet.*

A MS. drawing, apparently by Mr. BROWN, of the section "in the centre of the basin," a point no longer determinable, gives the following details:

Alluvium [*i. e.* rainwash.]
Gravel, 10 feet thick.
Freshwater shells only
Peat
Marine shells, 8 feet above high-water mark
Peat
Interrupted beds of marine and freshwater shells
Marine and freshwater bed at high-water mark } 20 feet.
Sand, remains of *Elephas, Rhinoceros, Bos, Deer, Hippopotamus.*
London Clay.

The dip is "30 feet in 300 towards the centre of the basin."

The REV. O. FISHER gives a longitudinal section differing but slightly from fig. 4. He describes the gravel of the cliffs east of Clacton as Glacial, and the freshwater deposit (7 of fig. 4) as seen above the beach in hollows on the surface of the London Clay, and gives the following vertical succession at a part of the cliff west of the Martello Tower, No. 6.

Sandy clay, with *Corbicula fluminalis*, small *Cardium edule, Paludina lenta*, and *Rissoa thermalis* (= 3 of fig. 4.)
Peaty shale with small *Scrobiculariæ*, pieces of *Balani* and brackish-water shells (= 5 of fig. 4.)

East of the Martello Tower he gives the following:

Obliquely-bedded gravel (= 2 of fig. 4; newer than 3.)
Peaty shale (as above) = 5 of fig. 4.
Layer of black flint- and white quartz- pebbles with shells of *Unio* - - - - - - - - } = 6 of fig. 4
Freshwater deposit with oak wood, hazel nuts, sticks, *Helix*, *Bithynia*, *Unio littoralis* and mammalian bones (Brown)
London Clay, with septaria.

Fig. 4 represents the section as seen in 1875. A hole was dug, by permission of the War Office authorities, at the foot of the cliff in front of the Martello Tower, to a depth of 10 feet below the beach-line without reaching the London Clay.

East of the pier the cliff consists of London Clay with a thick covering of bedded gravel and sand. This gravel is regarded by Mr. S. V. WOOD, Jun., as Post-Glacial, on the ground of its containing abundance of fragments of a peculiar pitted sandstone, common in the Post-Glacial gravels of East Essex, but rare in the Glacial gravels.†

* *Quart. Journ. Geol. Soc.*, vol. i., p. 341 (1845).
† *Geol. Mag.*, vol. iii., p. 349 (1866).

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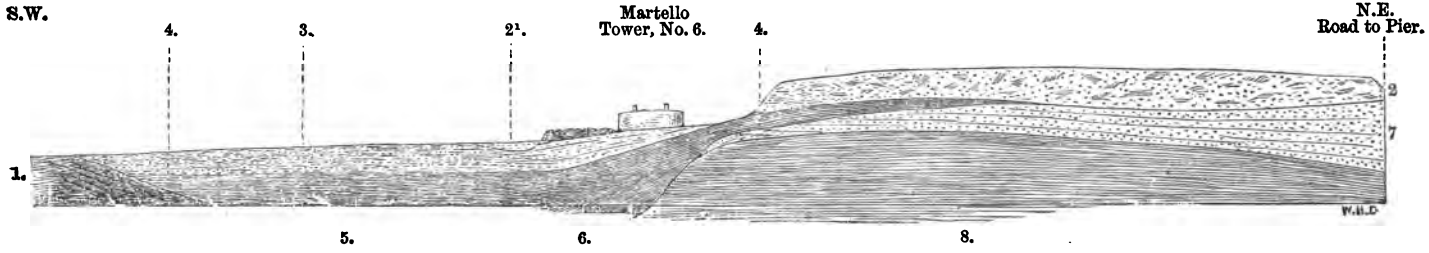
FIGURE 4.—*Diagram-section of Part of the Cliff at Clacton-on-Sea.* 1875.



1. Blown sand.
2. Irregularly bedded loamy gravel: at base a thin band of grey clay (passing westward into 5), traceable from the growth of moss and grass along it. 2^1. Gravel (which occurs in patches W. of the Martello Tower, and may be the same).
3. Red sandy loam, with groups of estuarine shells; about 6 feet.
4. Greenish-grey mottled clay, passing down into the next.
5. Estuarine peaty shale, dark brown, micaceous, with streaks of broken shells (among which fragments of *Balanus* and opercula of *Bithinia* are alone recognizable), and pieces of wood, the colour and friability probably due to weathering; about 14 feet thick, passing down into the bed below, which latter has been protected from weathering.
6. Freshwater bed. Dark blue loam, with great quantities of land and freshwater shells and vegetable remains, especially in the upper part.
7. Clean well-bedded gravel and sand; cut back by springs at the base, so as to leave a shelf of London Clay for some way. In the wedge-like end on the steep slope of London Clay at the path down the cliff from the Martello Tower, there was a large piece of fossil wood, but possibly the matrix was an old talus, formed before the deposit of the overlying part of 4.
8. London Clay.

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Professor W. B. DAWKINS* regards the fluviatile deposit of Clacton as Middle Pleistocene, its mammalia being the same as occur at Grays, &c. (the brickearth at which place this author regards as of that age),† except that some species of the Thames Valley deposits are not found at Clacton, whilst a peculiar form of fallow deer (*C. Browni*, Dawkins,) is found there.

The presence of purely fresh-water beds below high-water mark, passing up into estuarine deposits on the top of the cliff (20 feet above high-water mark), indicates gradual submergence and subsequent re-elevation.

Inland, at a brickyard by Magdalen Green, and nearly a mile south-westward of Great Clacton Church, the shallow pit showed clay, gravel, and sand, being found 2 or 3 feet below at the lower part. [W.W.].

RECENT DEPOSITS.

The alluvial deposits of this district are somewhat varied, and beside the ordinary river alluvium there are estuarine beds and shingle beaches.

The marshes south of St. Osyth are bounded on the seaward side by a broad ridge of shingle and sand, which rises above the level of the highest tides, and still continues to increase in width although freely used for road-metal and ballast. To the west it ends at Sandy Point, whilst eastward it passes into a line of dunes and the narrow sandy beach at the foot of Clacton cliffs.

Several similar but shorter ridges occur isolated in these marshes, and the foreshore, down to the lowest tidemark, consists of a thin layer of shingle over the alluvial mud.

The tidal flats round Mersea are all mud, and, except where oyster-beds have been laid down, the bottoms of the creeks are everywhere muddy. North of Mersea, however, a small mound of London Clay, capped with gravel, occurs on the edge of the tideway and is cut into by the creek, the bottom of which consists of the gravel thus obtained, there being not sufficient scour to remove it.

In Alresford creek the railway-bridge rests on piers sunk through the following beds, according to the Rev. O. FISHER‡:—

Marsh silt - - - - -	8 feet.
Black gravelly mud with *Scrobicularia*	6 inches.
Yellow virgin soil [altered London Clay]	3 feet.
Bluish-yellow [London] Clay - -	6 feet.

Mr. FISHER notes that, in the bed of the creek, gravel replaces the Recent beds and the southern piers are in sandy gravel under the *Scrobicularia*-bed.

In the marshes east of Colchester bones have been found in excavations at the Gas Works. "West of the Colne, 600 yards from the river, 10 miles from the sea, 5 feet above high-water mark, occur broken marine shells and concretions of carbonate of lime."§ A MS. note by Mr. J. BROWN, dated 1844, states that this deposit is 500 feet long and from a foot to 18 inches thick.

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* *Quart. Journ. Geol. Soc.*, vol. xxviii., p. 411.

† I can hardly agree with this, thinking rather that the deposits at Grays, &c. are amongst the latest of the Thames Valley Drifts.—W. W.

‡ *Quart. Journ. Geol. Soc.*, vol. xxii., p. 56.

§ Condensed from J. BROWN, *Quart. Journ. Geol. Soc.*, vol. i., p. 341 (1845).

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The site might be supposed from the description to be a little west of Colchester, where there is a peculiar shelly deposit under some trees frequented by flocks of starlings, who feed largely on the mollusca of the tidal flats, and of whose excreta this deposit consists. For this information I am indebted to Mr. H. LAVER, of Colchester.

Submerged Forest, Clacton.

The Rev. O. FISHER thus wrote in 1861:—"For about 600 "yards west of the end of the low cliff [*i.e.* about 220 yards west "of Martello Tower, No. 5] the shore at low water is occupied "by London clay, and then commences a submarine forest, "with stools of trees, &c."*

In 1875 the shore was much covered with sand; bare London Clay appeared near Martello Tower No. 4, and westward for about 600 yards, when the "forest" appeared for the first time, and extended about 530 yards further westward.

This bed consists of an unctuous blue clay, full of twigs and other vegetable remains, about 18 inches thick at the most, and lying on an uneven surface of London Clay. It is undergoing denudation on the seaward edge and over the surface, but many stools and prostrate trunks of trees still exist. These appear to be of elm, and their roots do not penetrate into the London Clay. Remains of beetles are found in the hollow centres of the stools. The general surface is about 12 feet below high-water mark, and 2 feet above the low water mark of spring-tides. A report is current in the neighbourhood that a parish of the name of Alton once existed here, and one of the farms is called Alton Park, but no mention of the fact is made by Morant and other writers, and possibly the account arose from the existence of this wood. Similar legends are common round the coast, but are generally explicable by reference to the removal of cliffs, as at Walton Naze and Harwich. This bed is evidently due either to subsidence or to the passage inland of the low range of sand dune which may once have sheltered a wood situate below high-water level. The existence of foundations on the verge of the tidal flat of St. Peter's Sands, 7 miles W.S.W. seems to favour the theory of subsidence within the Historic era, as at present alluvium is being deposited there. Attention has already been drawn to this point by the writer.†

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* *Geol. Mag.*, vol. v., p. 214.

† *Geol. Mag.*, dec. ii., vol. iii., pp. 143, 144 (1876).

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APPENDIX 1.—WELL SECTIONS.

ARDLEIGH.—1½ miles towards Colchester, nearly level with the kilnyard.

Rev. W. B. CLARKE.—*Trans. Geol. Soc.*, ser. 2, vol. v., p. 369.

	feet.
Red clay	20
Blue clay with oysters at the depth of 105 feet	90
To sand and water	110

ARDLEIGH.—House at entrance to brickyard about 2 miles N.E. from Colchester, about 1873.

Information given by MR. MANN, well-sinker.

250 feet of [London] Clay. No water.

CLACTON-ON-SEA.—Waterworks, 1878.

Sunk and communicated by Mr. T. TILLEY, and from specimens shown me by him. [W.W.]

About 50 feet above high-water mark.

Water brackish.

		feet.
Soil	(brown loam)	2
[Post-Glacial Drift, 18 feet.]	Brown and grey sandy clay	5
	Gravel	5
	Whitish sand, with flints	1
	Brown sand	5
	Conglomerate and gravel	2
[London Clay, 170 feet.]	Dark grey clay	136
	Dark brown sandy clay, with water	10
	Brown clayey sand, with water	14
	Grey shelly clay	2
	Grey and buff clay	8
[London Clay, or Reading Beds, 24 feet.]	Light-brown clay (mottled)	7
	Brown mottled clay	2
	Dark brown sand and clay	3
	Brown sand (partly clayey)	12
[Reading Beds, 56 feet.]	Brown and light-green sand	6
	Red and green mottled clayey sand	2
	Green-grey clay	14
	Dark brownish-grey clay and sand	20
	Black and green sand	10
	Green clayey sand	2
	Green clayey sand, with flints	2
	To Chalk	270
Chalk		20
		290

There is some doubt as to the division between the London Clay and the Reading Beds. The original account, moreover, makes the depth to the Chalk 268 feet, the lowest bed of green sand (with flints) having been added from a specimen marked 270 feet.

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COLCHESTER.—Castle Brewery, 1878.

Information from MR. DANIELL and MESSRS. S. F. BAKER & SONS.

Height above Ordnance datum 80 feet.* Good supply to 65½ feet from surface.

			feet.
Made earth		about 10	
[Glacial Drift]	Sand	„ 10	30
	Gravel	„ 15	
[London Clay, 110 feet.]	Blue clay		45
	Plastic clay with veins of stone		65
[Woolwich and Reading Beds, 56 feet.]	Red and green sand and pebbles		9
	Hard green sand		4
	Grey sand		43
	To Chalk		196
Chalk			102
			298

A somewhat different account from specimens and from information from MESSRS. BAKER'S foreman is as follows:

		feet.
Old well [gravel and London Clay]		60
[London Clay]	Sandy clay, with bad water	12
	Blue clay, with claystone seams [septaria] from an inch to a foot thick	25
	Sand	3
	Hard blue clay	4½
	Sand	2
[Woolwich and Reading Beds (? with Thanet beds at base)].	Mottled red and green clay	20
	Sand	3
	Mottled clay	24
	Mottled sand	9
	Dark green sand	1
	Dark grey dead sand	39
	Brown clay	1
	Dead green sand	6
	Flints	½ to 1
	To Chalk	about 210

COLCHESTER.—Cavalry Barracks. Infirmary stables. S. of town.

Measured from a large-scale tracing in the Royal Engineers Office.
116 feet above sea level.
Water rose to 94 feet from surface.

		feet.
[Glacial Drift, 33½ feet.]	Hard sand	22½
	Loose sand	
	Very loose gravel	8
	Very loose gravel, with much water	3
[London Clay, 141½ feet.]	Yellow clay	1½
	Blue clay	85
	Hard stone in veins	3
	Very hard blue clay, with stones	13
	Very sandy clay, with a little water	3
	Blue clay, with veins of sand	18
	Blue and yellow clay, with particles of white	4
	Yellow and coloured clay	14

* Kindly levelled for the Geological Survey from a Bench mark in High Street, by MR. MORRIS.

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		feet.
[Woolwich and Reading Beds, 62 feet.]	Green sand	2
	Dark dead sand	6
	Dead sand	2
	Various colours [? sand]	3
	Dark sand, softer	3
	Blue clay	11
	Blue loamy sand, with water	34
	Flints	1
	To Chalk	237
Chalk, with flints		313
		550

Another version of the same well, from another tracing, was as follows, but there must be a mistake as to the thick mass of gravel on the Chalk :—

	feet.
Top soil	10
Red gravel	
Light sand and gravel	10
Dark sand and gravel	5
Dark shingle, watery	6
Yellow shingle	1
Yellow clay	4
Blue clay	86
Dark gravel	115
To chalk	237
Chalk	263
Total	500

A third version in *Geol. Mag.*, vol. ii., p. 102, makes London Clay and Reading Beds together 211 feet.

An older (?) well at Colchester Barracks, 108 feet deep in London Clay, is mentioned in Conybeare and Phillips' "Geology of England and Wales," (1822), p. 33.

COLCHESTER.—Eagle Brewery, East Hill, 1877.

From specimens taken at nearly every foot, and from information from Mr. H. STOPES.

30 feet above Ordnance datum.

Water abundant, rising to within 18 feet of the surface.

		feet.
[Post-Glacial Drift, &c., 21 feet.]	Made earth (bones, shells, &c.)	2
	Loamy brickearth	18
	Sandy gravel with impure water	¾ or 1
[London Clay 72 feet.]	Stiff blue clay	13
	Sandy clay (septaria at 42 feet)	13
	Fine sand with water	1½
	Brown sandy clay	9½
	Stiff brown and blue clay	8
	Septaria	1
	Stiff blue clay	8
	Stiff brownish yellow clay	2
	Clayey sand	3
	Stiff reddish brown clay, passing into	5
	Yellowish brown clay, passing into	2
	Blackish brown clay	2
	Yellowish brown clay	2
	Fine white quicksand	2
	Sandstone, 3 or 4 inches	

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		feet.
[Reading Beds, 55 feet.]	Mottled green and crimson loam	5
	Green sand	6
	Mottled green and crimson loam	2
	Very coarse green sand	2
	Mottled greenish loam	1
	Very coarse green sand	1
	Fine mottled grey and brown loam, passing into	3
	Dark grey sand	3
	Stiff dark grey clay	4
	Dark grey sand	2
	Dark grey plastic clay	1
	Dark grey sand	1
	Dark grey plastic clay	5
	Dark grey sand (fossil wood at 130 feet)	11
	Dark grey loam	3
	Chocolate-coloured clay	4
	Dark green sand	1
[Thanet Beds, 6 feet.]	Pink sand	1
	Dark green sand	3½
	Grey sand, with green coated flints	1½
	To Chalk	154
Chalk		43
		197

An older well here is disused. The following account of a well "about half way down East Hill," by the Rev. W. B. CLARKE, (*Trans. Geol. Soc.*, sec. 2, vol. v., p. 369) probably refers to this:—

	feet.
Gravel and earth	16
London Clay	66
To sand and water	82

COLCHESTER.—Mile End. Keeper's Lodge at 53rd milepost on the London and Ipswich Road.

Shaft 110 feet, bore 90 feet, all in loam of varying nature [London Clay].

COLCHESTER.—Waterworks, 1852. [N.W. corner of Town].

P. BRUFF.—*Proc. Inst. Civ. Eng.*, vol. xix., pp. 38, 39.

Shaft 40 feet, the rest bored.

Water-level 5 feet above high-water mark. Supply abundant. (1,250,000 gallons a week), from the bottom.

		feet.
Soil		6
[River-] Gravel		4
London Clay		70
[Reading Beds, 63 feet.]	Mottled clay	20
	Green sand	3
	Dark plastic clay	40
	To Chalk	143
Chalk, with flints		210
		353

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A different account is given in *Geol. Mag.*, vol. ii., p. 102, and in *Ann. Nat. Hist.* Ser. 2, vol. xii., p. 240 as follows:—

"Plenty of good water at 224 feet."	feet.
Soil and low-level gravel	12
London Clay, with much green sand in the lower beds	100 or 105
Reading Beds	30 or 25
To Chalk	142
Chalk, with flints	152
	294

LITTLE WIGBOROUGH.—Copt Hall [Marsh].

Dr. JAMES MITCHELL'S MSS., vol. iv., p. 187.*

80 or 90 gallons a minute.

Brown Clay	To chalk about 300.
Muddy black clay	
Quick sand, with salt water	
Stony gravel	
Blue clay	
Black sand	
Green sand, with water	
30 feet lower another spring	
20 „ „ black sand and green sand	

Noticed by Professor PRESTWICH, *Proc. Inst. Civ. Eng.*, vol. xxxvii., p. 110, under MERSEA ISLAND.

ROWHEDGE.—Messrs. Daniell's Brewery.

Information from MR. DANIELL.

About high-water mark. Water overflows.

To Chalk	130 feet.
In „	175 „
	305 „

STANWAY.—Mr. John Brown's [½ mile west of Union House].

DR. JAMES MITCHELL'S MSS., vol. iii., p. 90.

Dug through gravel	45 feet.
Bored „ London Clay	120 „

No water.

[This must be very near the base of the London Clay.]

TENDRING Union.

Information from Mr. HATLEY, well-sinker.

Base of London Clay at 150 feet.

TOLLESBURY MARSH.

From Mr. PURKISS, well-sinker, (from memory).

		feet.
Alluvium		50
London Clay		130
[? Lower London Tertiaries 60 feet.]	Sand	4
	Clay	2
	Sand	14
	Clay	8
	Sand	32
		240

* Through the kindness of Prof. Prestwich I have been able to examine the four volumes of MS. sections, &c. left by Dr. Mitchell.—W. W.

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Weeley Barracks.

Rev. W. B. Clarke, *Trans. Geol. Soc.*, Ser. 2, vol. v., p. 369.

Water rose 50 feet.

Gravel	20 feet.
London Clay, with septaria	126 ,,
To sand [Reading Beds]	146 ,,

West Bergholt Brewery.—New boring, 1875.

Sunk and communicated by Messrs. S. F. Baker & Sons with further particulars from Messrs. Daniell.

About 175 feet above the sea by aneroid. [W. H. D.]
Old shaft 147 feet, the rest bored.
Water stands about 128 feet from the surface, its level is not lowered more than a foot by pumping 200 or 300 barrels. The temperature averages 53°.

		feet.
Gravel		13
London Clay	Clay	137
	Sand	1
	White rock [septaria]	1½
	Clay	23
	Mottled clay with a few pebbles at the base	27
Reading and Thanet Beds	Sand, green and very hard	16
	Sand	41½
	To Chalk	260
Chalk		150
		410

An older well gave the following section, according to a rough drawing at the Brewery.

Shaft 133 feet, the rest bored.

		feet.
Gravel		13
London Clay		147
[Reading Beds, 70 feet?]	Spring [? sand]	5
	Clay	20
	Plastic clay	25
	Green sand	15
	Clay [specimen of dark grey loam at 230 feet]	5
	To Chalk	230
Chalk		223
		453

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APPENDIX 2.—LISTS OF FOSSILS.

1.—Microscopic Fossils from the Chalk, Colchester, (Well at Waterworks).

Compiled from a paper by Mr. J. Brown (*Ann. Nat. Hist.*, Ser. 2., vol. xii., pp. 240–242, pls. viii., ix.) The names of the Entomostraca and of the Foraminifera have been kindly revised by Prof. T. R. Jones, F.R.S. [W.W.]

Bryozoa.

Ceriopora, like C. tubioporacea, *Goldf.*
Dendropora? —— Melicertes.
Pustulopora, like P. (Ceriopora) madreporacea, Goldf.

Entomostraca.

Bairdia subdeltoidea, *Münster.*
Cythere concentrica, *Reuss* (=C. punctatula).
Cythereis ornatissima, *Reuss* (=C. ciliata).
Cytherella ovata, *Roemer* (given as ovalis).

Spongida.

Manon. Tragos.

Foraminifera.

Bulimina variabilis, *D'Orb.*
Cristellaria rotulata, *Lam.*
Flabellulina cordata, *Reuss.*
,, rugosa, *D'Orb.*
Frondicularia Archiacina, *D'Orb.*
,, Verneuiliana, *D'Orb.*
Globigerina cretacea, *D'Orb.*
,, marginata, *Reuss* (given as Rosalina).
Marginulina elongata, *D'Orb.*
,, ensis, *Reuss.*
,, trilobata, *D'Orb.*
Nodosaria limbata, *D'Orb.*
,, Zippei, *Reuss.*
Planorbulina ammonoides, *Reuss* (given as Rosalina).
Truncatulina Beaumontiana, *D'Orb.*

2.—Post-Glacial Fossils.

The following list has been compiled by Mr. Dalton, from various sources, the chief of which are named below, and the nomenclature has been revised by Mr. Etheridge. [W.W.]

Clacton-on-Sea.—Mammalia, Prof. W. B. Dawkins, *Quart. Journ. Geol. Soc.*, vol. xxv., p. 199, from Mr. Brown's collection and that at Jermyn street, and J. Brown, *Mag. Nat. Hist.*, ser. 2, vol. iv., p. 200.—Mollusca, J. Brown, *Ann. Mag. Nat. Hist.* vol. vii. pp. 427–428., and S. V. Wood, "Crag Mollusca" *Palæontograph. Soc.* 1856.—Entomostraca, Prof. T. R. Jones, *Palæontograph. Soc.* 1849, and *Ann. Nat. Hist.*, Ser. 2, vol. vi., pp. 25, 71.

Copford.—Mammalia, Prof. W. B. Dawkins, *Quart. Journ. Geol. Soc.*, vol. xxv., p. 194, from Mr. Brown's collection, and those in the British Museum, and Jermyn Street Museum.—Mollusca, J. Brown, *Quart. Journ. Geol. Soc.*, vol. viii., p. 184, and S. V. Wood, *loc. cit.*—Entomostraca, Prof. T. R. Jones, *loc. cit.*

Lexden.—Rev. O. Fisher, and T. V. Wollaston, *Quart. Journ. Geol. Soc.*, vol. xix., pp. 393 and 400.

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Marks Tey.—From specimens collected by the author.

The initials S. P. W.=On the authority of a MS. list by the late Dr. S. P. WOODWARD, communicated by his son Mr. H. B. WOODWARD.—O. F.=On the authority of the Rev. O. FISHER.—J. B.=On the authority of Mr. J. BROWN.

The letters b. and l. before the names of fossils, respectively mean that the species occurred *before* (or in beds below the Post-glacial) or are *living* now.

		Clacton.	Copford.	Lexden.
	MAMMALIA.			
b.l.	Arvicola amphibia, *Desm.*	×		
b.	Bison priscus, *Bojan.*	×	×	
b.	Bos primigenius, *Bojan.*	×	×	
	Castor		2 sp.	
l.	Cervus dama, *Linn.*	×		
	„ „ var. Browni, *Dawk.*	×		
b.l.	„ elaphus, *Linn.* (and at Mark's Tey ?)	×	×	
b.	„ megaceros, *Hart.*	×		×
b.	Elephas antiquus, *Falc.*	×		×
b.	„ primigenius, *Blum.*		×	
l.	Equus caballus-fossilis, *Mey.*	×	?	
	Felis spelæa, *Goldf.*	×		×
b.	Hippopotamus major. *Desm.*	×	×	
b.	Hyæna spelæa, *Goldf.*	×		
l.	Mus musculus, *Linn.*		×	×
	Rhinoceros antiquitatis, *Blum.* (=tichorhinus, *Cuv.*)			×
	„ leptorhinus, *Cuv.*	×		
	Ursus ferox, *Linn.*		?	
b.	„ spelæus, *Blum.*	?	?	
	FISH.	×	×	
	GASTEROPODA.			
l.	Achatina acicula, *Müll.* S. P. W.	×	×	
l.	Acme (or Acicula) lineata, *Drap.* (=fusca)		×	
	„ „ reversed variety		×	
b.l.	Ancylus fluviatilis, *Müll.*	×		
b.l.	„ lacustris, *Linn.*	×		
l.	Bulimus acutus, *Müll.*		×	
	„ Lackhamensis, *Mont.*	×		
l.	„ obscurus, *Müll.*		×	
b.l.	Bythinia tentaculata, *Linn.* (and at Mark's Tey)	×	×	
l.	„ ventricosa, *Gray.* S. P. W.		×	
b.l.	Carychium minimum, *Müll.*	×	×	
l.	Clausilia bidens, *Drap.* S. P. W.	×	×	
l.	„ biplicata, *Mont.* S. P. W.	×	×	
	„ plicatula, *Drap.*		×	
l.	„ Rolphii, *Leach.* S. P. W.		×	
l.	„ rugosa, *Drap.* (=nigricans)		×	
b.l.	Cochlicopa (Zua) lubrica, *Müll.*	×	×	
l.	„ (Azeca), tridens, *Pult.*	×	×	
	Fusus S. P. W.	×		
l.	Helix aculeata, *Müll.*	×	×	
l.	„ (Zonites) alliaria, *Müll.*	×	×	
b.l.	„ arbustorum, *Linn.*		×	
l.	„ (Zonites) cellaria, *Müll.*	×	×	
b.l.	„ concinna, *Jeff.*	×	×	
	„ conoidea *Sby.*	×		
l.	„ (Zonites) crystallina, *Müll.*	×	×	

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		Clacton.	Copford.
l.	Helix (Zonites) excavata, *Bean.*	×	
l.	„ fruticum, *Müll.*		×
l.	„ (Zonites) fulva, *Müll.*	×	×
l.	„ „ fusca, *Mont.*		×
b.l.	„ hispida, *Linn.*	×	×
l.	„ „ var. depilata, *Alder.*		×
l.	„ hortensis, *Lister*		×
l.	„ incarnata, *Müll.*		×
l.	„ lamellata, *Turton.*		×
l.	„ lapicida, *Linn.*	×	×
l.	„ (Zonites) lucida, *Drap.* S.P.W.	×	×
b.l.	„ nemoralis, *Linn.*	×	×
l.	„ (Zonites) nitida, *Müll.*	×	
l.	„ „ nitidula, *Drap.*		×
b.	„ plebeia, *Drap.*	×	×
l.	„ pulchella, *Müll.*	×	×
	„ „ var. costata, *Müll.*		×
l.	„ (Zonites) pura, *Alder.*	×	×
l.	„ pygmæa, *Drap.*		×
l.	„ (Zonites) radiatula, *Alder.*	×	×
l.	„ „ rotundata, *Müll.*	×	×
	„ ruderata, *Studer*	×	×
l.	„ rufescens, *Penn.* S. P. W.	×	×
l.	„ sericea, *Müll.*		×
l.	„ umbilicata, *Mont.* J. B.	×	
l.	„ virgata, *Da Costa*	×	
	Hydrobia marginata, *Mich.*	×	
l.	„ ulvæ, *Penn.*	×	
b.l.	Limax agrestis, *Linn.*		×
l.	„ Sowerbii, *Fér.*		×
l.	Limnæa auricularia, *Linn.*	×	
b.l.	„ palustris, *Müll.*	×	×
b.l.	„ peregra, *Müll.*	×	×
b.l.	„ stagnalis, *Linn.*	×	×
b.l.	„ truncatula, *Müll.*	×	×
l.	Littorina obtusata, *Linn.* (=littoralis)	×	
	Odostomia J. B.		?
	Paludina lenta ? *Brand.* O. F.	×	
	„ minuta, *Sby.* J. B.	×	
b.l.	Physa fontinalis, *Linn.* S. P. W.	×	
l.	„ hypnorum, *Linn.*		×
b.l.	Planorbis albus, *Müll.*	×	×
l.	„ carinatus, *Müll.*	×	
b.l.	„ complanatus, *Linn.* (=marginatus, *Drap.*)	×	×
l.	„ contortus, *Linn.*	×	×
b.l.	„ corneus, *Linn.*	×	
	„ helicoides, *Sby.*	×	
l.	„ imbricatus, *Müll.* S. P. W.	×	×
l.	„ lævis, *Alder.*	×	
l.	„ lineatus, *Walker* (=lacustris, *Lightf.*)	×	
b.l.	„ nautileus, *Linn.*	×	
b.l.	„ nitidus, *Müll.*	×	×
b.l.	„ spirorbis, *Müll.*	×	×
l.	„ vortex, *Linn.*	×	×
l.	Pupa anglica, *Potier* and *Mich.*		×
l.	„ cylindrica, *Fér.* S. P. W.	×	
b.l.	„ marginata, *Drap.* S. P. W.	×	×
b.l.	„ muscorum, *Müll.*	×	×
l.	„ palustris, *Leach.*	×	×
l.	„ umbilicata, *Drap.*	×	×
	Rissoa thermalis, *Linn.*	×	
b.l.	Succinea oblonga, *Drap.*	×	

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		Clacton.	Copford.	Lexden.
l.	Succinea Pfeifferi, *Rossm.* - - S. P. W.	×	×	
b.l.	„ putris, *Linn.* - - -	×	×	
b.l.	Turritella communis, *Risso.* - - S. P. W.	×		
b.l.	Valvata cristata, *Müll.* (and at Mark's Tey) - -	×	×	
b.l.	„ piscinalis, *Müll.* (including V. antiqua, *Morris*) (and at Mark's Tey) - -	×	×	
l.	Vertigo alpestris, Fér. (?=pygmæa, *Drap.*) - -		×	
l.	„ angustior, *Jeff.* - - - -		×	
l.	„ antivertigo, *Drap.* - - - -	×	×	
l.	„ edentula, *Drap.* - - - -	×	×	
l.	„ minutissima, *Hartm.* - - - -	×	×	
l.	„ pusilla, *Müll.* - - - -	×	×	
l.	„ pygmæa, *Drap.* - - - -	×	×	
l.	„ substriata, *Jeff.* (=sexdentata, *Mont.*) -		×	
	Conchifera.			
l.	Anodonta cygnea, *Linn.* - - - -	×	×	
b.l.	Cardium edule, *Linn.* - - - - -	×		
l.	Corbicula fluminalis, *Müll.* - - - -	×	×	
b.l.	Mactra ovalis, *Sby.* - - - J. B.	×		
b.l.	Mytilus edulis, *Linn.* - - - - -	×		
b.l.	Pisidium amnicum, *Müll.* - - - -	×	×	
b.l.	„ Henslowianum, *Shep.* - -	×		
l.	„ obtusale - - - -		×	
l.	„ pulchellum, *Jenyns.* - - -	×	×	
l.	„ pusillum, *Gmelin.* - - - -	×	×	
b.l.	Scrobicularia piperata, *Bellon.* - - -	×		
b.l.	Sphœrium (Cyclas) corneum, *Linn.* - - -	×		
b.l.	„ „ rivicola, *Leach.* - - -		×	
b.l.	Tellina Balthica, *Linn.* (=solidula) - S. P. W.	×		
b.	„ tenuis, *Da Costa* - - - J. B.	×		
b.	Unio littoralis, *Lam.* - - - - -	×		
	Polyzoa.			
	Flustra - - - - - J. B.	×		
	Insecta.			
	Buprestis - - - - - -			
	Cassida - - - - - -			×
	Chrysomela - - - - - -			×
	Coccinella - - - - - -			×
	Cossyphus - - - - - -			×
	Curculio - - - - - -			×
	Licinus - - - - - -			×
				×
	Crustacea.			
	Balanus - - - - - J. B.	×		
	Candona candida, *Müll.* (including C. lucens, *Baird*)	×	×	
	„ subæqualis, *Jones* - - - -		×	
	Cypris Browniana, *Jones* - - - -	×		
	„ gibba, *Ramd.* - - - - -	×	×	
	„ (Candona) reptans, *Baird* - - -	×	×	
	„ sp. - - - -	×		
	Cytherideis trigonalis, *Jones* - - - -	×		
	Foraminifera.			
	Triloculina inflata, *Mont.* - - - J. B.	×		

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		Clacton.	Copford.
	PLANTÆ.		
	W. C.=Determined by Mr. W. CARRUTHERS, F.R.S.		
b.l.	Alnus glutinosa, *Linn.* - - - W. C.	×	
	Chara hispida, *Smith* - - - - J. B.	×	
	„ sp. - - - - - -	×	×
b.l.	Corylus avellana, *Linn.* - - - W. C.	×	
	Quercus - - - - - J. B.	×	
	Sphagnum - - - - - J. B.		×
b.l.	Taxus baccatus, *Linn.* - - - W. C.	×	

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290. Braithwell.
293. Hallam Moors. 4s.
295. Handsworth.
296. Laughton-en-le-Morthen.
299. ——.
300. Harthill.

SCOTLAND.

Scale, six inches to a mile.

Edinburghshire.

2. Edinburgh, &c.
3. Portobello, Musselburgh, &c.
6. Gilmerton, Burdie House, &c.
7. Dalkeith, &c.
8. Preston Hall. 4s.
12. Penicuick, Coalfields of Lasswade, &c.
13. Temple, &c.
14. Pathead. 4s.
17. Brunston Colliery, &c.
18. Howgate.

Haddingtonshire.

Six inches to a mile.

8. Prestonpans, &c. Price 4s.
9. Trenent, Gladsmuir, &c. Price 6s.
13. Elphinstone, &c. Price 4s.
14. Ormiston, East Salton, &c.

Fifeshire.

Six inches to a mile.

24. Markinch, &c.
25. Scoonie, &c.
30. Beath, &c.
31. Auchterderran. 4s.
32. Dysart, &c.
33. Buckhaven.
35. Dunfermline.
36. Kinghorn.
37. Kinghorn. 4s.

Ayrshire.

Six inches to one mile.

19. Newmilns.
26. Glenbuck. 4s.
27. Monkton, &c.
28. Tarbolton, &c.
30. Aird's Moss.
31. Muirkirk. 4s.
33. Ayr, &c.
34. Coylton.
36. Grieve Hill.
40. Chiltree.
41. Dalleagler.
42. New Cumnock.
46. Dalmellington.
47. Benbeock.
50. Daily.
52. Glenmoat.

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